

Written Re-Examination

Programming Mobile Applications Medialogy, 2nd semester

Tuesday 15 August 2023, 9.00 – 13.00

Navn: _____

Studienr: _____

Programming Mobile Applications

Re-Examination

13 August 2023, 9.00 – 13.00

Instructions

- You have 4 hours to complete this examination.
- Neither electronic devices nor written material are allowed in the examination room.
- This examination consists of 10 questions. Each question is worth 10 marks. You must obtain at least 50 marks to pass.
- Do not write any answers on this question paper—answers written on the question paper will be ignored by the examiner. Write all your answers on the writing paper provided.
- Do not write your answers in pencil and do not use a pen with red or green ink. Use a pen with blue or black ink.
- Hand in no more than one answer to each question.
- Do not turn over until you are told to do so by the invigilator.

Question 1

- a) Which of the following are examples of a *module*, as this term is used in software engineering:
- function
 - package
 - variable
 - class
 - constant
 - method
- b) Suppose a method in a class, *A*, uses a method defined in a class, *B*. Does this imply that class *B* depends on class *A*, or does it imply that class *A* depends on class *B*?
- c) All else being equal, should we generally aim to increase the amount of a coupling in a system, or should we rather aim to decrease the amount of coupling in a system?
- d) Which of the following statements are true?
- (A) A single interface can, in principle, encapsulate any number of different modules.
 - (B) A single module can, in principle, implement any number of different interfaces.
 - (C) Proper use of encapsulation and modularity typically makes code shorter.
 - (D) Proper use of encapsulation and modularity typically makes code easier to debug.
- e) If a module is easily decomposable into smaller modules, does that imply that it has high cohesion, or does it imply that it has low cohesion?

[2 marks for each correct part]

Question 2

- a) Which of the following statements are true?
- (A) The state of an object is determined by its methods.
 - (B) The behaviour of an object is determined by its methods.
 - (C) It is possible for two objects to have equal state but different identity.
 - (D) It is possible for two objects to have the same identity but different state.
- [4 marks]
- b) Suppose we have a class in which a method is defined that has the following signature:

```
+ setTime(time : Time, zone : Time) : boolean
```

- i) What is the selector of this method?
- ii) What is the return type of this method?
- iii) What is the visibility of this method?
- iv) Would it be possible to define a method with the following signature in the same class?

```
+ setTime(zone : Time, time : Time) : boolean
```

[4 marks]

- c) Suppose we have a class, *A*, in which a method is defined with the following signature:

```
+ sortItems(direction : Direction) : boolean
```

Now suppose we have another class, *B*, which is a subclass of *A*, in which we define methods with the following signatures:

```
+ sortItems(dir : Direction) : boolean  
+ sortItems(dir : Direction, parallel : boolean) : boolean
```

Which of these two methods in class *B* overrides the `sortItems` method defined in class *A*?

[2 marks]

Question 3

What does the following Java program print out to the console when it is run?

```

3 public class Q3 {
4     public static void main (String[] args) {
5         for(int x = -3; x < 3; x+=2)
6             for(int y = -3; y < 3; y+=2)
7                 if (y!=0)
8                     System.out.print(x%y+" ");
9     }
10 }

```

[10 marks]

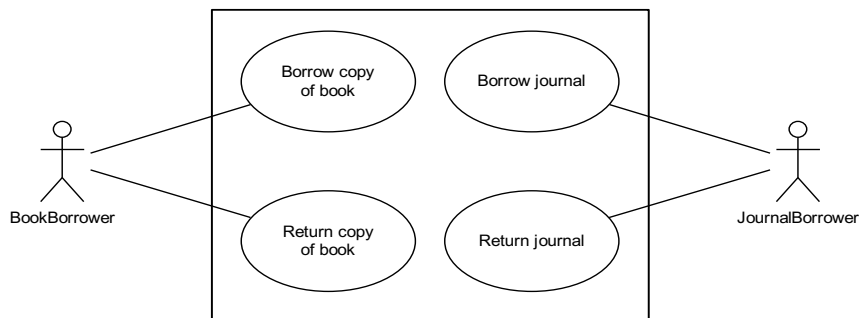
Question 4

- a) Which of the following three UML diagram types are Behaviour diagrams?

Use case diagram
Class diagram
State machine diagram

[2 marks]

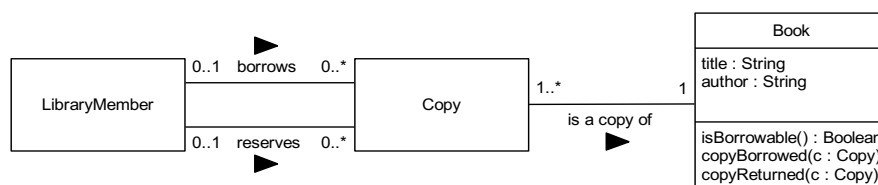
- b) Study the following UML diagram:



- i) What type of UML diagram is this?
ii) Give an example from the diagram of an Actor?
iii) What does the rectangular box in this diagram denote?

[3 marks]

- c) Study the following UML diagram:



- i) How many Book objects are associated with each Copy object? [1 mark]
ii) How many LibraryMember objects can be associated with each Copy object? [1 mark]
iii) What attributes does a Book object have? Include attributes that can be inferred from any associations. [3 marks]

Question 5

Study the following Java program and answer the questions that follow it.

```
3 public class Q5 {
4
5     static interface I {
6         int sum();
7         double mean();
8     }
9
10    static class A implements I {
11        int x, y;
12
13        A(int x, int y) {this.x = x; this.y = y;}
14        public int sum() {return x + y;}
15        public double mean() {return sum()/2.0;}
16    }
17
18    static class B extends A {
19        int z;
20
21        public B(int x, int y, int z) {super(x,y); this.z = z;}
22        public int sum() {return super.sum()+z;}
23        public double mean() {return sum()/3.0;}
24    }
25
26    public static void main(String[] args) {
27        I[] array = new I[2];
28        array[0] = new A(1,2);
29        array[1] = new B(3,4,5);
30        for(I i : array)
31            System.out.println(i.sum()+" "+i.mean());
32    }
33
34 }
```

- What does this program print to the console when it is run? [4 marks]
- In line 15, why is the denominator of the expression that is evaluated written as “2.0” rather than just “2”? [1 mark]
- Give an example from the program of a polymorphic variable. [1 mark]
- Give an example from the program of a dynamically bound call to a method. [1 mark]
- Give an example from the program of an abstract method declaration. [1 mark]
- Give an example from the program of a superclass’s constructor being called. [1 mark]
- What would happen if the word “public” were removed from line 14? Why? [1 mark]

Question 6

What does the following program print out to the console when it is run?

```
3 public class Q6 {
4
5     static Double parseInput(String s) {
6         try {
7             return Double.parseDouble(s);
8         } catch (NumberFormatException e) {
9             System.out.println("Could not understand "+s);
10        }
11        return null;
12    }
13
14    public static void main(String[] args) {
15        String[] strs = new String[]{"1","1.0","3.141","boat", "3e4"};
16        for(String s : strs) {
17            Double d = parseInput(s);
18            if (d != null)
19                System.out.println(d + " is a double");
20        }
21    }
22 }
```

[10 marks]

Question 7

Study the following Java program and answer the questions that follow it.

```
1 package dk.aau.create.pma.reexam2023;
2
3 import java.util.Random;
4
5 public class Q7 {
6
7     static int x = 1000;
8     static Random r = new Random( );
9
10    static class AddX implements Runnable {
11
12        int c = 0;
13
14        AddX(int c) {this.c = c;}
15
16        public void run() {
17            try {
18                Thread.sleep((long)(r.nextDouble()*1000));
19            } catch (InterruptedException e) {
20                System.out.println("Thread "+Thread.currentThread().getName()+" has been interrupted");
21            }
22            x += this.c;
23        }
24    }
25
26    static class MultiplyX implements Runnable {
27
28        int c = 0;
29
30        MultiplyX(int c) {this.c = c;}
31
32        public void run() {
33            try {
34                Thread.sleep((long)(r.nextDouble()*1000));
35            } catch (InterruptedException e) {
36                System.out.println("Thread "+Thread.currentThread().getName()+" has been interrupted");
37            }
38            x *= this.c;
39        }
40    }
41
42    public static void main(String[] args) {
43
44        Thread a = new Thread(new AddX(50), "a");
45        Thread b = new Thread(new MultiplyX(2), "b ");
46        a.start();
47        b.start();
48        try {
49            a.join();
50            b.join();
51        } catch (InterruptedException e) {
52            e.printStackTrace();
53        }
54        System.out.println("x = "+x);
55    }
56 }
57 }
```

- What are the two possible outputs that this program prints to the console? [4 marks]
- Under what conditions would line 20 be executed? [2 marks]
- What is the purpose of lines 50 and 51? [2 marks]
- What is the maximum amount of time that the current thread could sleep in line 18? [2 marks]

Question 8

Study the following Java program and answer the questions that follow. Assume that any necessary imports have been provided earlier in the file containing the program.

```
12 public class Q8 extends JFrame implements ActionListener {
13
14     private static final long serialVersionUID = 1L;
15     private JTextField textField = new JTextField("TextField");
16     private JLabel label = new JLabel("Label");
17     private JButton button = new JButton("Button");
18
19     public Q8() {
20         setTitle("Q8");
21         setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
22         FlowLayout layout = new FlowLayout();
23         getContentPane().setLayout(layout);
24         getContentPane().add(textField);
25         getContentPane().add(label);
26         getContentPane().add(button);
27         button.addActionListener(this);
28         textField.addActionListener(this);
29         setResizable(false);
30         pack();
31         setVisible(true);
32     }
33
34     public void actionPerformed(ActionEvent e) {
35         label.setText(textField.getText());
36         button.setText("Pressed");
37     }
38
39     public static void main(String [] args) {
40         javax.swing.SwingUtilities.invokeLater(new Runnable() {
41             public void run() {
42                 new Q8();
43             }
44         });
45     }
46
47 }
```

- Draw a sketch of what the GUI looks like when the program starts, before the user has started interacting with it. [2 marks]
- Draw a sketch of what the GUI would look like after a user types "Hello" into the text field and then presses the Enter button. [2 marks]
- Which object functions as the ActionListener that responds to the user's interactions with the GUI? [2 marks]
- Is the user able to change the size and shape of the GUI while the program is running? [2 marks]
- What is the purpose of line 21? [2 marks]

Question 9

For each of the following statements, state whether it is true or false:

- a) In Android, each app runs in its own process and each process has its own virtual machine.
- b) The Android OS is a multi-user Windows system.
- c) In Android, there are four different types of component: activities, services, content receivers and broadcast providers.
- d) Any application can start any activity in any app installed on the system provided that the app that owns the requested activity allows it.
- e) An activity represents a single screen GUI.
- f) Services run in the foreground, have no user interface and typically perform long-running operations.
- g) A content provider manages a shared set of application data that could be any persistent storage location accessible from the app.
- h) A broadcast receiver responds to system-wide broadcast announcements that could be sent from any running application.
- i) An implicit intent makes a request for a component of a particular class.
- j) An explicit intent makes a request for a component that can carry out a particular task.

[1 mark for each correct part]

Question 10

- a) In an Android app, which lifecycle callback runs automatically on an Activity when it loses focus but does not become completely invisible. [2 marks]
- b) Which one of the following statements is true?
(A) A ViewGroup is a special type of View.
(B) A View is a special type of ViewGroup.
[2 marks]
- c) What is the purpose of an intent filter and where are intent filters defined in an Android app?
[2 marks]
- d) Which activity lifecycle callback automatically runs immediately after an activity becomes invisible?
[2 marks]
- e) Which activity lifecycle callback automatically runs immediately after the onStart() method? [2 marks]

END OF EXAMINATION